Corporate bond liquidity
before and after the onset of the subprime crisis

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The problem

- Corporate bonds trade at smaller prices - i.e. higher promised yield - than similar riskless bonds
- This is because of risk of default (default, loss, risk premium of default risk)
- Liquidity risk - or better illiquidity risk - also contributes to the spread
- But how do we measure it? Can we disentangle credit and liquidity?
- We propose a measure which consistently (across quality, over time) captures a liquidity contribution to corporate bond spreads
- We study its properties across ratings, across maturity and its reaction to the onset of the financial crisis

What we show

- The combination of
  - superior data quality of intra-day corporate bond prices using TRACE data
  - natural experiment provided by the onset of the subprime crisis
- help us
  - identifying a set of liquidity proxies which contribute to bond spreads across ratings, across maturity and pre-and post crisis
  - defining an equally weighted average of four standardized liquidity measures which consistently contributes to spreads across time and rating
  - providing new estimates for the liquidity component of corporate bond spreads
  - shedding new light on the *size* and *effect* of commonly used liquidity proxies
  - showing that both the size of the liquidity proxies and the response of spreads to these variables change at the onset of the crisis.

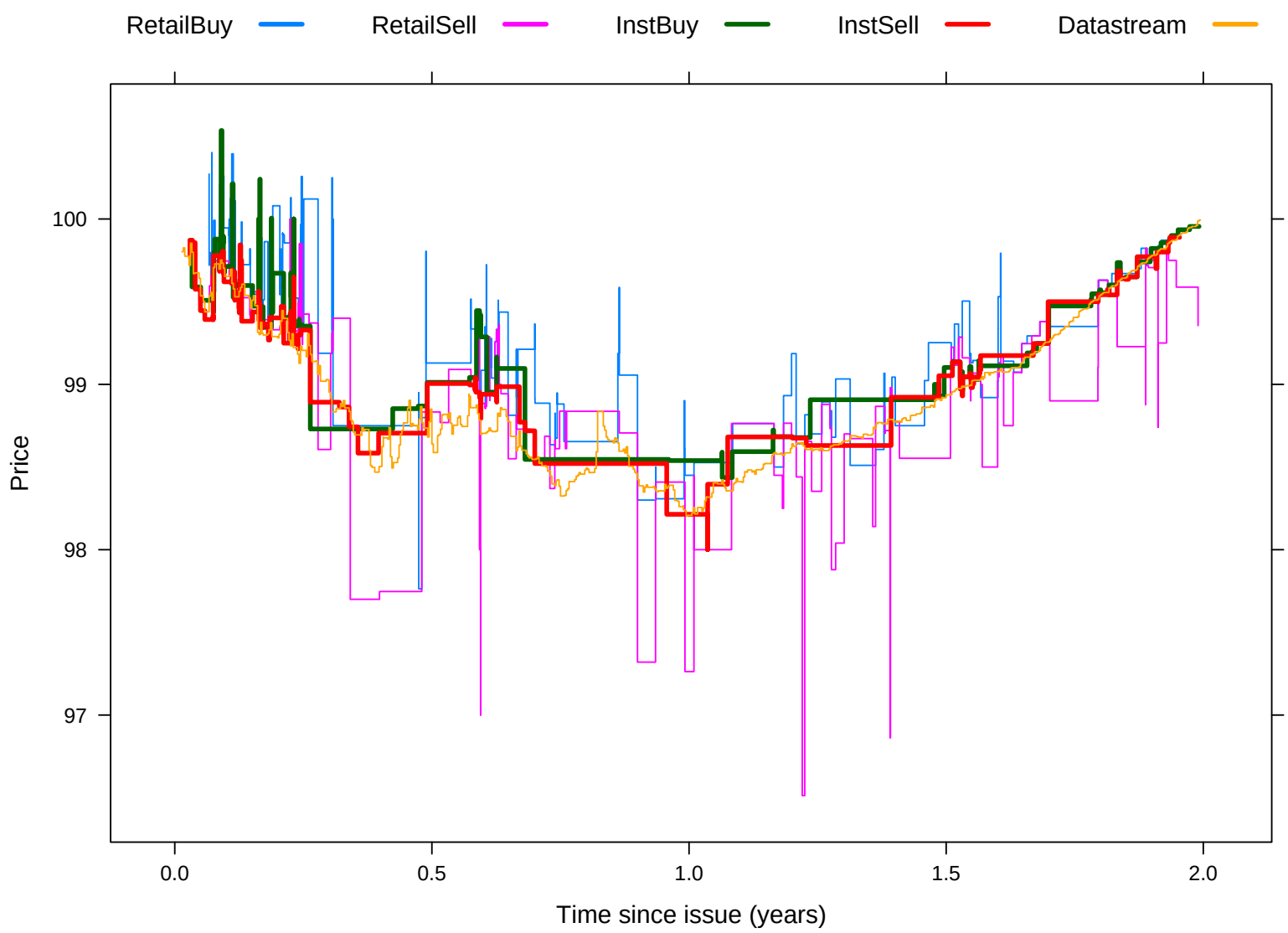
What we do

- Observe yields and yield spreads quarterly of bonds
- Use detailed TRACE data to compute a collection of liquidity proxies
- Use detailed firm-level information to control for credit risk
- Perform 'marginal' regressions introducing one liquidity at a time controlling for credit
- Extract a principal component of liquidity proxies which is a robust contributor to spreads
- Define an operational measure of liquidity risk
- Compute the contribution ín the more liquid segment of corporate bonds to spreads across time, ratings and maturity
- Perform robustness checks

Why we use large trades

- TRACE allows us to measure volumes of trade
- Truncate large trades at USD 5 million for investment grade and USD 1 million for speculative grade
- We can see very small trades
- We see a pattern of much larger (implied) bid-ask spreads and very large price differences in intraday trading
- This confirms that factors different from liquidity and credit are at play for small trades
- We therefore look at trades in excess of USD 100.000

Why we use large trades



Some related papers

Related papers are (among others)

- Chen, Lesmond, and Wei (2007), Longstaff, Mithal, and Neis (2005), Huang and Huang (2005), Han and Zhou (2008)
- Goldstein, Hotchkiss, and Sirri (2007), Edwards, Harris, and Piwowar (2007), Bessembinder, Maxwell, and Venkararam (2006), Green, Hollifield and Schürhoff (2007)
- Ericsson and Renault (2006), Bao, Pan, and Wang (2008), Acharya and Pedersen (2005)
- Houweling, Mentink and Vorst (2005)
- Mahanti, Nashikkar, Subrahmaniam, Chacko, Malik (2008); Johnson (2008)

Transaction data from TRACE

- Transaction data from TRACE for the period (including quarters leading up to) January 1, 2005 - June 30, 2009
- Straight coupon bullet bonds
- No trades smaller than $USD100,000$
- Share prices for the issuing firms from CRSP
- Firm accounting figures from Bloomberg

- **Roll measure**: Roll (1984) find that (under certain assumptions) an estimate of the effective bid-ask is $2\sqrt{-cov(\Delta P_i, \Delta P_{i-1})}$
- **Unique roundtrip costs (URC)**: If there are 2 (investor-dealer-investor) or 3 (investor-dealer-dealer-investor) trades with the same trading volume on a given day, they are (likely) part of a unique roundtrip. URC is the difference between the highest and lowest price (in percentage of price).

An illustration of URC

Issue: **EOC.MQ**

Description: **NATIONAL ELECTRICITY COMPANY OF CHILE, INC.**

Coupon Rate: **8.625**

Maturity Date: **08/01/2015**

Execution Date	Time	Status	Quantity	Price	Reporting Party Side
01/07/2009	12:57:48	T	100000	109.510	S
01/07/2009	14:43:00	T	250000	108.250	B
01/07/2009	14:43:00	T	250000	108.750	S
01/14/2009	11:20:02	T	30000	110.892	S
01/15/2009	15:49:00	T	25000	109.237	B
01/15/2009	15:49:00	T	25000	109.237	D
01/15/2009	15:55:52	T	25000	111.237	S
01/16/2009	09:56:00	T	100000	108.615	D
01/16/2009	09:56:00	T	100000	108.615	B
01/16/2009	14:16:58	T	100000	109.500	S

Liquidity proxies

The Amihud price impact measure

- The Amihud (2002) measure estimates how much a trade of a given size moves prices:

$$Amihud_t = \frac{1}{N_t} \sum_{j=1}^{N_t} \frac{|\frac{P_j - P_{j-1}}{P_{j-1}}|}{Q_j}$$

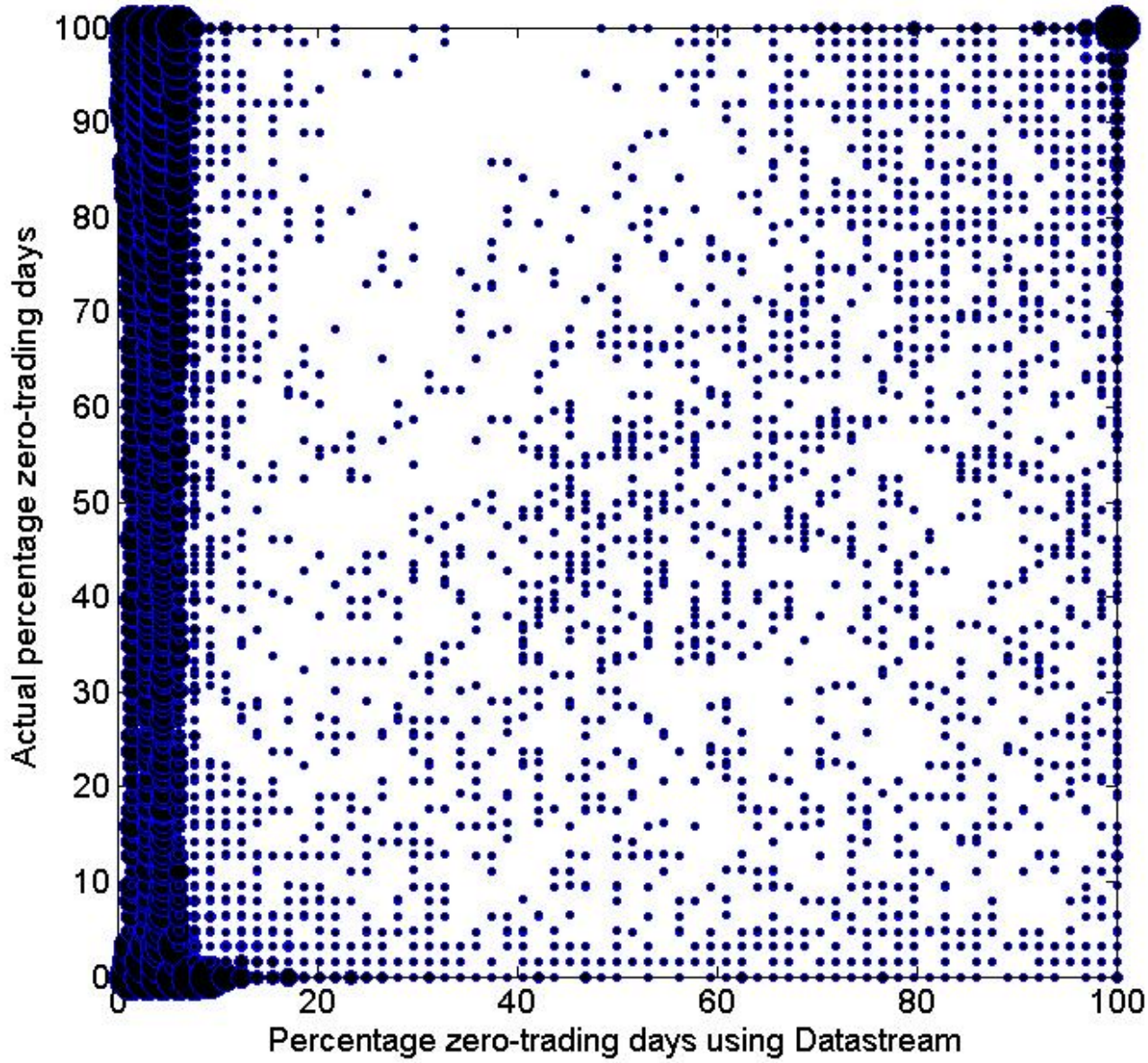
Liquidity proxies

Trading frequency measures

- **Turnover**: $\frac{\text{quarterly trading volume}}{\text{amount outstanding}}$
- **Zero-trading days**: The percentage number of days a bond does not trade (Chen, Lesmond, Wei (2007)). We include both **bond** ZTDs and **firm** ZTDs (percentage of days the issuing firm does not have a bond that is trading).

On measuring zero trading days

Datastream vs TRACE



- Investors might require extra compensation for holding assets which are illiquid when asset returns are low
- This suggests adding a beta to our regressions measuring covariation between illiquidity costs and market returns
- Beta is linear in the standard deviation of illiquidity costs
- We include in our regressions the quarterly **standard deviations of** the daily **Amihud measure** and **unique roundtrip costs**.

The liquidity measures - summary stats

Panel A: Summary statistics for liquidity proxies

	Amihud	Roll	firm zero	bond zero	turnover	URC	Amihud risk	URC risk
99th	0.0813	8.39	92.1	96.8	0.247	0.0156	0.1592	0.01702
95th	0.0427	3.16	76.2	93.5	0.136	0.0096	0.0792	0.00997
75th	0.0120	1.05	12.5	79.7	0.070	0.0041	0.0298	0.00427
50th	0.0044	0.53	0.0	60.7	0.045	0.0022	0.0147	0.00220
25th	0.0015	0.29	0.0	31.7	0.028	0.0012	0.0064	0.00102
5th	0.0003	0.12	0.0	6.3	0.012	0.0005	0.0011	0.00024
1st	0.0000	0.06	0.0	0.0	0.005	0.0002	0.0002	0.00003

Panel B: Correlation matrix for liquidity proxies

	Amihud	Roll	firm zero	bond zero	turnover	URC	Amihud risk	URC risk
Amihud	1.00							
Roll	0.16	1.00						
firm zero	−0.08	0.11	1.00					
bond zero	−0.08	0.18	0.46	1.00				
turnover	−0.20	0.04	0.03	0.04	1.00			
URC	0.72	0.20	−0.03	−0.03	−0.13	1.00		
Amihud risk	0.61	0.10	−0.12	−0.12	−0.11	0.69	1.00	
URC risk	0.57	0.14	−0.12	−0.19	−0.11	0.87	0.69	1.00

Table 1: Statistics for liquidity proxies. This table shows statistics for corporate bond liquidity proxies. The proxies are described in detail in Section 3 and are calculated quarterly from 2004:Q4 to 2009:Q2. Panel A shows quantiles for the proxies. Panel B shows correlations among the proxies.

Regressions of spreads on single proxies

Control for credit risk

- For each rating class we run separate regressions using quarterly observations

$$\begin{aligned}\text{Spread}_{it} = \alpha + \gamma\ \text{Liquidity}_{it} + \beta_1\ \text{Bond Age}_{it} + \beta_2 \text{Amount Issued}_{it} \\ + \beta_3\ \text{Coupon}_{it} + \beta_4 \text{Time-to-Maturity}_{it} + \beta_5\ \text{Eq.Vol}_{it} \\ + \beta_6\ \text{Operating}_{it} + \beta_7\ \text{Leverage} + \beta_8\ \text{Long Debt}_{it} \\ + \beta_{9,pretax}\ \text{Pretax dummies}_{it} + \beta_{10} 10\text{ y Swap}_t \\ + \beta_{11}(\text{10y-2y})\ \text{Swap}_t + \beta_{12} \text{forecast dispersion}_{it} + \epsilon_{it}\end{aligned}$$

- i is bond issue, t is quarter, and Liquidity_{it} contains one of several liquidity proxies defined below

Which variables matter in marginal regressions?

- Significant in most rating categories pre and post crisis:
  - Amihud measure
  - Amihud measure risk
  - Roundtrip costs (URC)
  - URC risk
- The signs are consistent for these proxies
- Significance of other measures is more scattered, and signs vary

Marginal regressions of spreads on liquidity proxies

Panel A: Marginal liquidity regressions, pre-subprime (2004:Q4-2007:Q1)

	AAA	AA	A	BBB	spec
Amihud	1.15***	2.08***	4.14***	3.68	14.12
	(4.87)	(3.85)	(3.18)	(1.52)	(1.63)
Roll	0.02***	0.02***	0.01	0.02	0.05
	(3.18)	(3.48)	(1.48)	(0.53)	(1.26)
firm zero	0.000	−0.001	0.000	−0.001*	−0.005
	(0.46)	(−1.42)	(0.74)	(−1.66)	(−1.60)
bond zero	−0.000	−0.000	0.000	−0.003**	−0.012**
	(−0.09)	(−0.86)	(1.13)	(−2.22)	(−2.33)
turnover	−0.27***	−0.12	−0.03	−0.03	−0.05
	(−6.52)	(−0.97)	(−0.31)	(−0.18)	(−0.09)
URC	3.83**	7.11***	18.91***	47.47***	69.29**
	(2.03)	(2.66)	(2.61)	(3.76)	(2.26)
Amihud risk	0.39*	0.55*	1.43**	3.46***	9.48**
	(1.82)	(1.87)	(2.42)	(3.46)	(2.29)
URC risk	2.08**	3.98*	9.16**	25.99***	57.20***
	(2.30)	(1.95)	(2.29)	(3.18)	(3.67)

Marginal regressions of spreads on liquidity proxies

Panel B: Marginal liquidity regressions, post-subprime (2007:Q2-2009:Q2)

	AAA	AA	A	BBB	spec
Amihud	2.93*** (2.98)	18.40*** (2.94)	6.80 (0.82)	21.94** (2.54)	22.47 (1.52)
Roll	0.04*** (2.58)	−0.02 (−1.55)	0.04 (0.87)	0.19* (1.76)	−0.73 (−1.47)
firm zero	−0.016 (−1.46)	−0.000 (−0.03)	−0.000 (−0.07)	−0.023** (−2.22)	−0.047** (−2.05)
bond zero	0.007*** (7.26)	0.002 (0.73)	0.013** (2.31)	−0.016 (−0.53)	−0.087 (−1.49)
turnover	−2.95*** (−11.87)	−2.12 (−1.11)	−0.74 (−0.31)	−2.97 (−0.33)	14.47 (0.82)
URC	20.50*** (2.88)	191.63*** (3.08)	209.47*** (4.74)	212.15*** (2.96)	−143.70 (−0.57)
Amihud risk	1.99 (1.25)	18.87*** (4.74)	20.66*** (3.26)	21.42** (2.22)	24.11** (2.43)
URC risk	17.40** (2.07)	167.60*** (3.71)	190.46*** (4.03)	270.28*** (4.23)	233.16** (2.13)

Principal component analysis of liquidity proxies

- Given the high level of correlation between our main measures, we choose to extract principal components
- The measures are of course on very different scales, so we extract PCs from the correlation matrix
- Principal component analysis reveals that PC1 loads mainly on the four measures
- This is true pre and post crisis - and weights for the four are almost identical
- PC2 is related to zero trading days, PC3 is mainly turnover

Principal component loadings - before crisis

Panel A: Principal Component loadings, pre-subprime (2004:Q4-2007:Q1)

	1PC	2PC	3PC	4PC	5PC	6PC	7PC	8PC
Amihud	0.45	0.05	−0.12	−0.05	0.44	0.70	−0.12	0.28
Roll	0.26	0.33	0.08	−0.86	−0.27	−0.06	0.06	0.02
firm zero	−0.04	0.64	−0.02	0.39	−0.56	0.36	0.07	0.02
bond zero	−0.00	0.67	−0.10	0.10	0.56	−0.45	0.05	0.11
turnover	−0.02	0.07	0.98	0.07	0.15	0.08	0.01	0.03
URC	0.52	0.06	0.03	0.15	0.00	−0.10	−0.39	−0.73
Amihud risk	0.47	−0.11	0.01	0.16	−0.01	−0.09	0.85	−0.09
URC risk	0.49	−0.12	0.06	0.21	−0.29	−0.40	−0.31	0.60
cum. % explained	39%	59%	72%	81%	89%	94%	99%	100%

Principal component loadings - after crisis

Panel B: Principal Component loadings, post-subprime (2007:Q2-2009:Q2)

	1PC	2PC	3PC	4PC	5PC	6PC	7PC	8PC
Amihud	0.46	0.04	−0.10	−0.10	−0.07	0.73	0.43	0.21
Roll	0.06	0.47	0.35	−0.78	0.10	−0.02	−0.17	0.02
firm zero	−0.11	0.59	−0.28	0.33	0.62	0.20	−0.17	0.00
bond zero	−0.12	0.64	−0.07	0.21	−0.67	−0.16	0.21	0.12
turnover	−0.14	0.05	0.88	0.39	0.08	0.20	0.12	0.01
URC	0.52	0.15	0.06	0.09	0.09	−0.26	0.28	−0.73
Amihud risk	0.46	0.03	0.07	0.21	−0.30	0.19	−0.78	−0.04
URC risk	0.51	0.02	0.09	0.13	0.23	−0.51	0.10	0.63
cum. % explained	39%	58%	71%	81%	88%	94%	99%	100%

Regressing spreads on the PCs

Still controlling for credit

- We now regress spreads on the PCs
- We still control for credit
- PC1 is consistently significant and consistently with positive sign
- Not true of the others

Regression of spreads on principal components (before)

Credit controls not shown

Panel A: Multivariate liquidity regressions, pre-subprime (2004:Q4-2007:Q1)

	AAA	AA	A	BBB	spec
intercept	−0.4	0.2	−0.5	2.2***	−0.1
	(−1.24)	(1.20)	(−1.62)	(2.84)	(−0.03)
1PCA	0.01***	0.02***	0.03***	0.05***	0.30***
	(3.22)	(12.31)	(3.28)	(2.88)	(5.65)
2PCA	0.01	−0.00	0.04***	−0.06	−0.19
	(0.58)	(−0.09)	(3.41)	(−1.30)	(−1.19)
3PCA	−0.014***	−0.006	0.018***	−0.005	0.093
	(−4.20)	(−0.72)	(2.66)	(−0.21)	(0.88)
4PCA	−0.020**	−0.022***	−0.002	−0.015	0.112*
	(−2.32)	(−2.94)	(−0.18)	(−0.67)	(1.92)
5PCA	0.00	0.02***	0.03*	−0.05	−0.02
	(0.01)	(3.08)	(1.88)	(−1.22)	(−0.16)
6PCA	0.00	0.01	0.03***	0.03	0.24*
	(0.69)	(0.81)	(4.19)	(0.65)	(1.91)
7PCA	0.00	−0.00	−0.00	−0.02*	−0.10*
	(0.27)	(−0.28)	(−0.55)	(−1.70)	(−1.68)
8PCA	0.02***	0.02	−0.01	−0.23***	−0.17
	(3.07)	(1.43)	(−0.74)	(−2.58)	(−1.56)

Regression of spreads on principal components (after)

Credit controls not shown

Panel B: Multivariate liquidity regressions, post-subprime (2007:Q2-2009:Q2)

	AAA	AA	A	BBB	spec
intercept	−2.5**	−2.6	1.0***	24.9	30.2*
	(−2.00)	(−1.00)	(2.66)	(1.42)	(1.65)
1PCA	0.05*	0.48***	0.45***	0.67***	1.16***
	(1.91)	(4.50)	(4.64)	(3.18)	(4.33)
2PCA	−0.08	0.15	0.26**	−0.03	−0.73
	(−0.57)	(1.60)	(2.27)	(−0.05)	(−1.21)
3PCA	0.066	0.153***	0.146***	0.389*	0.349
	(1.21)	(2.96)	(3.27)	(1.75)	(0.90)
4PCA	−0.125	0.283***	0.267***	0.110*	0.900
	(−1.35)	(5.14)	(4.07)	(1.81)	(1.40)
5PCA	−0.35***	−0.18	−0.17***	−0.46	0.52
	(−2.75)	(−1.17)	(−7.65)	(−0.90)	(0.97)
6PCA	−0.09*	−0.17	−0.41*	−0.30*	1.00**
	(−1.76)	(−1.30)	(−1.67)	(−1.70)	(2.57)
7PCA	0.07	−0.39*	−0.22	−0.44	−0.58**
	(0.68)	(−1.79)	(−1.24)	(−1.08)	(−1.98)
8PCA	0.12*	0.07	−0.29**	1.04	0.63
	(1.72)	(0.30)	(−2.14)	(1.11)	(0.54)

Our liquidity measure

- The loadings on the PC1 are very close to equal
- The significance of PC1 is robust
- We simply define a liquidity measure which is the equally weighted combination of these measures
- Think of each bond's liquidity proxies as being scaled by a standard deviation and mean measured across bonds
- We do the computations separately for the two regimes

Contribution to spreads from liquidity

- Call our measure λ
- Let λ_{it} denote the value of the liquidity measure for bond i at date t
- Perform the regression for each rating class

$$spread_{it}^{R} = \alpha^{R} + \beta^{R}\lambda_{it} + \text{credit risk controls}_{it} + \epsilon_{it}$$

- Group bonds according to maturity also
- Within each category (rating, maturity), sort λ_{it} according to size
- Define 5% and 50% quantiles λ_5, λ_{50}
- Report $\beta^{R}(\lambda_{50} - \lambda_5)$
- Bootstrap standard errors

Liquidity spread:

Difference between median and high liquidity level

Panel A: Liquidity component in basis points, pre-subprime (2004Q4-2007:Q1)

	average	0-2y	2-5y	5-30y	N 0-2y	N 2-5y	N 5-30y
AAA	0.8	0.6 (0.3;0.8)	0.9 (0.5;1.3)	1.1 (0.6;1.5)	162	178	193
AA	1.0	0.7 (0.3;1.1)	1.0 (0.4;1.7)	1.3 (0.5;2.2)	704	667	498
A	2.4	1.5 (0.6;2.3)	2.5 (1.1;3.9)	3.2 (1.4;4.9)	1540	1346	1260
BBB	3.9	2.8 (1.4;4.4)	4.0 (1.9;6.2)	4.7 (2.3;7.3)	517	270	553
spec	57.6	45.0 (32.3;57.4)	44.0 (31.5;56.0)	83.9 (60.2;106.8)	270	324	480

Liquidity spread:

Difference between median and high liquidity level

Panel B: Liquidity component in basis points, post-subprime (2007:Q2-2009:Q2)

	average	0-2y	2-5y	5-30y	N 0-2y	N 2-5y	N 5-30y
AAA	4.9	2.5 (0.5;4.4)	4.5 (0.9;8.0)	7.9 (1.7;14.1)	110	149	155
AA	41.8	23.5 (12.9;33.2)	37.1 (20.3;52.4)	64.7 (35.5;91.4)	493	572	483
A	50.7	26.6 (15.3;39.2)	51.0 (29.3;75.1)	74.5 (42.9;109.7)	762	878	890
BBB	92.7	64.3 (36.5;92.7)	115.6 (65.6;166.6)	98.1 (55.7;141.4)	123	159	256
spec	196.8	123.6 (80.2;157.3)	224.0 (145.3;285.1)	242.7 (157.4;308.8)	133	129	201

Contribution to spreads from liquidity

- We also try with higher liquidity measure
- Within each category (rating, maturity), sort λ_{it} according to size
- Define 5% and 75% quantiles λ_5, λ_{75}
- Report $\beta^R(\lambda_{75} - \lambda_5)$
- Bootstrap standard errors

Panel A: Liquidity component in basis points, pre-subprime (2004Q4-2007:Q1)

	average	0-2y	2-5y	5-30y	N 0-2y	N 2-5y	N 5-30y
AAA	1.4	1.0 (0.5;1.3)	1.2 (0.7;1.7)	2.0 (1.1;2.8)	162	178	193
AA	1.7	1.1 (0.4;1.7)	1.6 (0.6;2.6)	2.4 (0.9;3.8)	704	667	498
A	4.4	2.8 (1.2;4.3)	4.3 (1.8;6.8)	6.1 (2.6;9.6)	1540	1346	1260
BBB	8.4	5.8 (2.4;9.1)	8.9 (3.6;13.9)	10.4 (4.2;16.3)	517	270	553
spec	117.1	81.5 (61.2;104.4)	90.4 (67.9;115.8)	179.4 (134.6;229.6)	270	324	480

Liquidity spread:

Difference between low and high liquidity level

Panel B: Liquidity component in basis points, post-subprime (2007:Q2-2009:Q2)

	average	0-2y	2-5y	5-30y	N 0-2y	N 2-5y	N 5-30y
AAA	9.2	4.4 (0.9;7.9)	8.0 (1.7;14.2)	15.2 (3.2;27.3)	110	149	155
AA	68.5	37.8 (21.2;53.4)	64.0 (35.8;90.5)	103.9 (58.1;146.9)	493	572	483
A	92.6	53.8 (29.4;78.8)	95.9 (52.5;140.6)	128.1 (70.1;187.7)	762	878	890
BBB	176.5	138.6 (76.0;203.3)	201.6 (110.5;295.6)	189.4 (103.8;277.8)	123	159	256
spec	420.5	294.0 (196.2;383.0)	390.5 (260.6;508.7)	577.1 (385.2;751.8)	133	129	201

Using Treasury instead of swap rates as riskless rate

Panel A: Liquidity component in basis points, pre-subprime (2004Q4-2007:Q1)

	average	0-2y	2-5y	5-30y	N 0-2y	N 2-5y	N 5-30y
AAA	1.6	1.1 (0.8;1.4)	1.7 (1.2;2.1)	2.0 (1.4;2.5)	162	178	193
AA	1.7	1.1 (0.8;1.5)	1.8 (1.3;2.3)	2.3 (1.6;3.0)	704	667	498
A	2.8	1.7 (0.9;2.6)	2.9 (1.5;4.3)	3.8 (1.9;5.5)	1540	1346	1260
BBB	4.0	2.9 (1.4;4.4)	4.1 (1.9;6.2)	4.9 (2.3;7.3)	517	270	553
spec	57.8	45.2 (33.9;57.4)	44.1 (33.1;56.0)	84.2 (63.2;106.9)	270	324	480

Using Treasury instead of swap rates as riskless rate

Panel B: Liquidity component in basis points, post-subprime (2007:Q2-2009:Q2)

	average	0-2y	2-5y	5-30y	N 0-2y	N 2-5y	N 5-30y
AAA	1.0	0.5 (0.3;5.4)	0.8 (0.5;8.1)	1.7 (0.9;16.6)	110	149	155
AA	40.6	22.9 (11.5;35.2)	36.1 (18.2;55.5)	63.0 (31.8;96.8)	493	572	483
A	47.6	25.0 (12.9;37.6)	47.9 (24.7;72.1)	70.0 (36.1;105.4)	762	878	890
BBB	94.0	65.2 (36.0;97.4)	117.2 (64.8;175.1)	99.5 (55.0;148.6)	123	159	256
spec	189.9	119.3 (79.4;154.9)	216.3 (144.0;280.9)	234.2 (156.0;304.2)	133	129	201

The maturity structure

- We also try to group by rating only (across maturities)
- ...and by maturity only (across ratings)

Maturity effects

Panel A: Liquidity component in fraction of spread, pre-subprime (2005:Q1-2007:Q1)

rating	AAA	AA	A	BBB	spec
fraction in pct	3 (2;5)	4 (2;7)	11 (5;18)	8 (3;12)	24 (18;30)
N	533	1869	4148	1340	1075

maturity	0-1y	1-2y	2-3y	3-4y	4-5y	5-8y	8-10y	10-30y
fraction in pct	3 (2;4)	7 (4;9)	13 (8;17)	13 (8;18)	13 (8;17)	11 (7;15)	8 (5;11)	10 (7;14)
N	1596	1613	1241	891	641	1187	578	1218

Panel B: Liquidity component in fraction of spread, post-subprime (2007:Q2-2009:Q2)

rating	AAA	AA	A	BBB	spec
fraction in pct	7 (1;12)	42 (23;60)	26 (14;39)	29 (16;41)	23 (16;30)
N	414	1549	2533	539	464

maturity	0-1y	1-2y	2-3y	3-4y	4-5y	5-8y	8-10y	10-30y
fraction in pct	11 (7;14)	20 (13;27)	23 (15;31)	27 (18;38)	31 (20;42)	44 (28;60)	33 (21;44)	43 (28;53)
N	809	819	675	657	556	817	568	598

Matched regression

- What if we have not measured credit risk correctly?
- We pair bonds from the same firm with similar maturity
- We insist that hey have the same regression coefficient on the liquidity variable but introduce a constant dummy for each bond
- This will capture any credit risk misspecification
- Due to reduction in data set, we perform this in larger buckets: investment grade and speculative grade
- λ again consistently significant
- We also perform Durbin-Wu-Hausman test for endogeneity using bond age as instrument

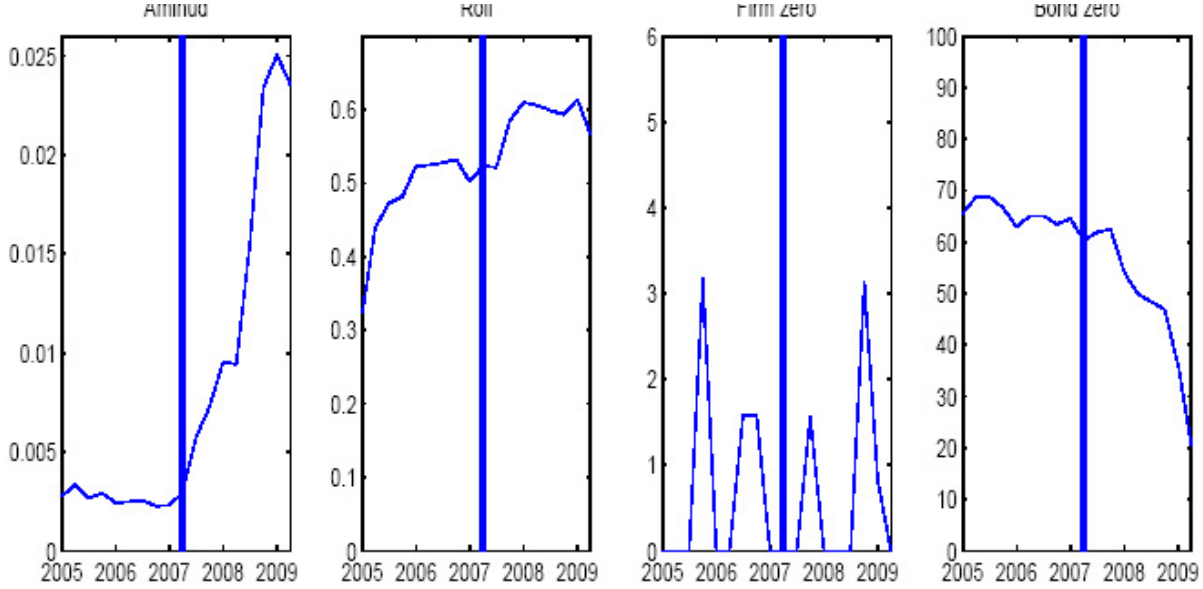
Robustness control for credit

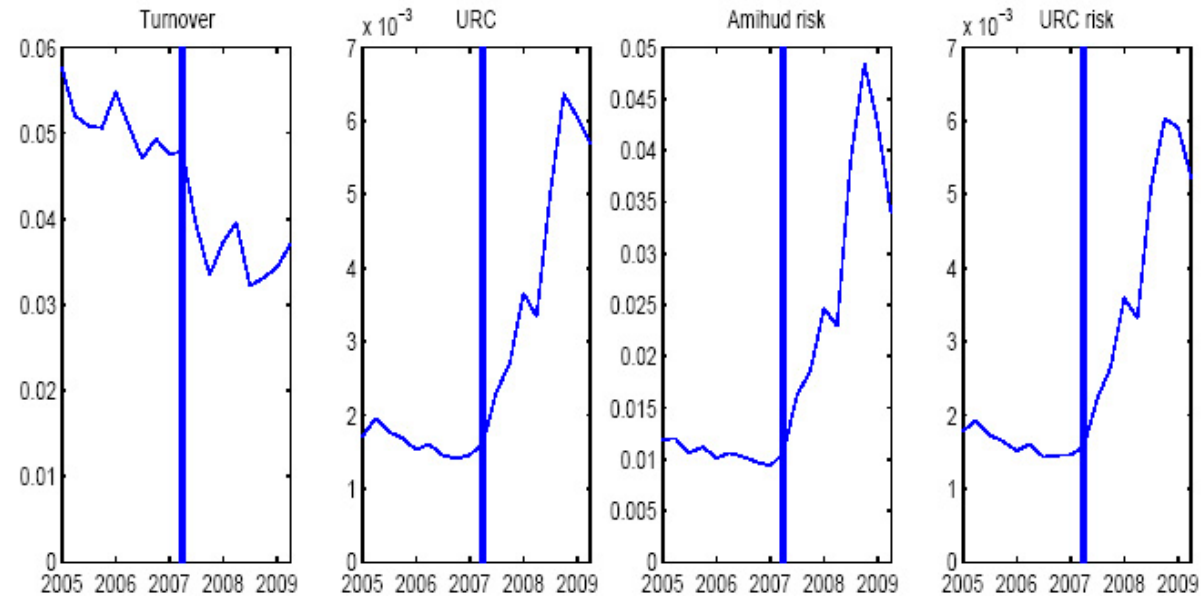
	pre-subprime		post-subprime	
	investment	spec	investment	spec
λ	0.04^{***} (4.93)	0.46^{***} (3.16)	0.70^{***} (3.33)	2.60^{**} (2.25)
Amihud	2.26^{***} (5.11)	16.80^{***} (3.51)	16.10^{***} (3.04)	54.65 (1.54)
Roll	0.03^{***} (3.56)	0.16^{**} (2.54)	0.05^{**} (2.14)	0.39 (1.44)
bond zero	0.00^{***} (5.85)	0.01^{**} (2.28)	0.00 (0.78)	0.03 (1.12)
turnover	0.11^{*} (1.87)	1.48^{*} (1.72)	-3.21 (-1.46)	72.74 (1.63)
URC	8.48^{***} (3.72)	125.03^{**} (2.55)	104.34^{**} (2.43)	-95.04 (-0.58)
URC risk	1.30 (0.69)	57.15^{**} (2.15)	39.09^{***} (2.97)	-103.42 (-0.74)
Amihud risk	0.64^{***} (4.21)	9.44^{***} (2.79)	6.56^{***} (3.19)	39.63^{***} (4.60)

Dynamic of key variables

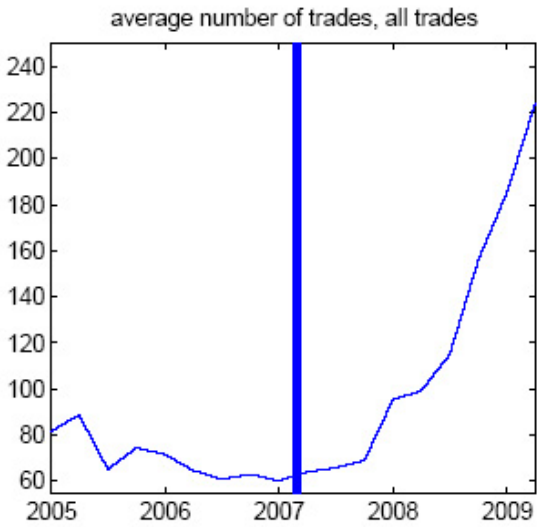
- Note distinct patterns in increase in our four variables
- Remarkable fact: Lower turnover but also fewer bond zero days after onset
- This can be explained by smaller trade sizes

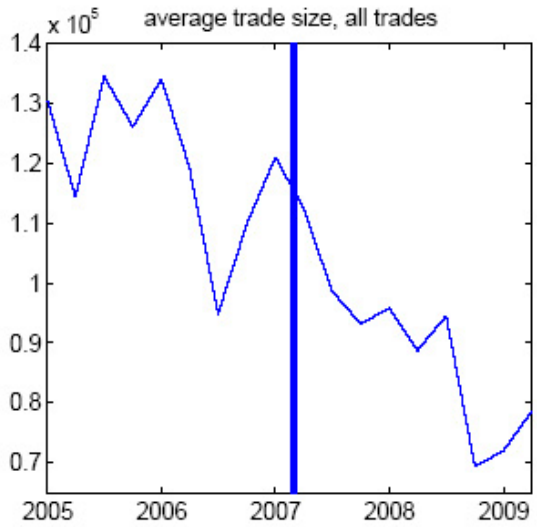
Dynamics of liquidity proxies





On trading volume and size





Ongoing improvements

- Introduction of 'liquidity betas' as regressors measuring the extent to which the individual bond's liquidity varies with overall bond market liquidity
- New release of TRACE (out - but not in WRDS) will give us information on individual deals

Summary

- TRACE data and onset of crisis provide new insights into liquidity proxies
- Based on a principal component analysis we propose a simple equally weighted average of four liquidity measures
- This measure consistently (across ratings, in different regimes) is a significant determinant of credit spreads in corporate bonds
- Larger liquidity components after the onset of the crisis (both in levels of component and in regression coefficient response)
- Higher components for lower credit quality, and mostly increasing with maturity
- Amihud measure should be defined for institutional trades